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PATENT SPECIFICATION

1,081,818

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improvements in or relating to Flexible Tube Pumps

We, THE DISTILLERS COMPANY LIMITED, of 12, Torphichen Street, Edinburgh 3, Scotland, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is concerned with improvements in or relating to glandless flexible tube pumps.

A glandless flexible tube pump according to the present invention comprises a rotary helical drive shaft and at least three movable elements each element being individually movable in a reciprocatory linear sense relatively to the axis of rotation of the shaft, the shaft being so arranged that when rotated it causes the elements to move against a flexible tube when interposed between the elements and an abutment means, the movement of the elements being in such a sequence relatively to each other as to progressively deform the tube and thereby impart unidirectional flow to fluid in the tube.

The fluid can be a liquid, gas or particulate matter which flows like a liquid or gas.

Any type of flexible tube used in glandless tube pumps can be used in the pumps of the present invention. By "flexible" is meant that the tube must be capable of recovering its tubular shape after being deformed at least when fluid is passed into the input end. The recovery of shape can be brought about by the elastic memory of the tube wall alone or this memory in conjunction with the pressure of fluid entering the tube. The preferred cross section is circular but tubes with other cross sections can be used. An example of the material from which the tube can be made is silicone rubber.

The abutment means must have sufficient rigidity to allow the flexible tube to be deformed against it by the movable elements. The abutment means can be adjustable in position in relation to the elements. Preferably the abutment means is adjustable and biased for movement against the pressure of the flexible tube when deformed by the movable elements. Most suitably the abutment means comprises a backplate which is spring loaded. The use of an adjustable abutment means facilitates the use of flexible tubes of different wall thickness. The use of an adjustable abutment means biased for movement against the pressure of the tube provides a form of pressure relief valve in the event of a blockage occurring in the tube when the pump is used.

The shape of the movable elements are not critical. Preferably each element is in the form of a lamina which can be, for example, rectangular or square. It is preferably rectangular with a slightly rounded or bevelled surface in the area which contacts the tube. The elements can be made from such materials as metal or plastic, the preferred plastics are nylon or phenol/formaldehyde resins.

At least three movable elements must be present to achieve unidirectional flow of fluid in the flexible tube. More elements are preferred so as to reduce wear on the flexible tube. For example, the preferred number is about twenty four where the helical drive shaft has a three inch pitch. The elements must be individually movable in a reciprocatory linear sense relatively to the axis of rotation of the shaft.

Most suitably an adjustable stop device is provided which is capable of limiting the movement of the movable elements away from the flexible tube thereby allowing the output of the pump to be varied. The device

can comprise a movable stop member against which the elements can abut to limit their movement away from the tube and means such as screw member for varying the distance of the stop member relatively to the tube.

The rotary helical drive shaft is so shaped that when it is rotated about its axis it is capable of causing the movable elements to move in such a sequence relatively to each other as to progressively deform the flexible tube and thereby impart unidirectional flow of fluid in the tube. The movement imparted to the elements by the shaft preferably causes the tube to be progressively occluded when deformed.

Most suitably the helical shaft is so shaped as to cause a sine wave movement in the movable elements when it is rotated.

Movement of the movable elements away from the tube can be brought about by pressure of the tube wall as it recovers its tubular shape. The movement can be effected by the pull of gravity on the elements. Preferably it is effected by combination of gravity and pressure of the tube wall.

Pumps according to the present invention are easy to manufacture, and are readily assembled in that the flexible tube can be easily inserted into the body. The output of the pump can be easily varied by adjusting the working volume of the tube by means of the adjustable stop device described. The use of a helical drive shaft facilitates a smooth progressive deformation of the tube to give good flow characteristics in the pumped fluid and excellent tube life.

The invention is described further with reference to the drawing filed with the Provisional Specification in which Figure 1 shows a longitudinal section of a pump and Figure 2 shows a cross section through the line A-A' shown in Figure 1.

With reference to Figures 1 and 2 the pump comprises a backplate 1 and a deformable flexible tube 2 made of silicone rubber. The tube nas a surface in contact with the backplate and another surface in contact with the ends of a plurality of rectangular movable elements 3. Each movable element has a slightly rounded surface at the area which contacts the tube. The movable elements are so arranged as to contact a helical drive shaft 4 the axial ends of which are journalled into a pump housing 5. The movable elements being individually movable in a reciprocatory linear sense in relation to the axis of rotation of the shaft.

The length of travel of the rectangular movable elements away from the flexible tube is limited by an adjustable stop member 6, against which the elements can abut on their furthest distance of travel from the tubes. The distance of the adjustable stop member 6 relatively to the tube can be varied by a screw member 7 which is tapped through the pump housing. The adjustable stop member and screw member being so arranged that when the screw member is turned it causes the stop member to move either towards or away from the tube, thus limiting the length of travel of the elements away from the flexible tube. This limits the expansion of the flexible tube and thereby allows the output of the pump to be varied.

The backplate is provided with a spring 8 which bears against the pump housing, the spring and backplate being so arranged that the backplate applies pressure on the flexible tube to ensure that it is completely flattened and occluded when deformed by the rectangular movable elements. The use of a spring loaded backplate allows flexible tubes of differing wall thickness to be used in the pump and also provides a form of pressure relief device in the event of a blockage in the tube when the pump is operated.

In operation of the pump the helical drive shaft is rotated about its axis in the direction shown by the arrow C. This movement moves the rectangular movable elements against the flexible tube in such a sequence relatively to each other as to progressively deform the tube and thereby impart unidirectional flow of fluid in the direction shown by the arrow D. The movement of the elements away from the tube is brought about by the following factors, the elastic memory of the tube wall, the pressure of fluid entering the tube and gravity. The movement of the elements away from the tube allows it to expand so that fluid can enter.

The helical drive shaft is preferably rotated by an electric motor.

WHAT WE CLAIM IS :—

1. A glandless flexible tube pump comprising a rotary helical drive shaft and at least three movable elements, each element being individually movable in a reciprocatory linear sense relatively to the axis of rotation of the shaft, the shaft being so arranged that when rotated it causes the elements to move against a flexible tube when interposed between the elements and an abutment means, the movement of the elements being in such sequence relatively to each other as to progressively deform the tube and thereby impart unidirectional flow to fluid in the tube.

2. A pump as claimed in claim 1 wherein the helical shaft is so shaped that when rotated it causes the elements to move in a sine wave movement against the tube.

3. A pump as claimed in claim 1 or claim 2 wherein the abutment means is adjustable in position in relation to the elements.

4. A pump as claimed in claim 3 wherein the abutment means is biased for movement against the pressure of the flexible tube when deformed by the movable elements.

5. A pump as claimed in claim 4 wherein the abutment means is biased for movement by means of a spring.

6. A pump as claimed in any one of the preceding claims wherein the abutment means is a backplate.

7. A pump as claimed in any one of the preceding claims wherein each element is in the form of a lamina.

8. A pump as claimed in any one of the preceding claims wherein the movable elements have a slightly rounded or bevelled surface in the area which contacts the tube.

9. A pump as claimed in any one of the preceding claims wherein an adjustable stop device is provided which is capable of limiting the movement of the movable elements away from the tube thereby allowing the output of the pump to be varied.

10. A pump as claimed in claim 9 wherein the adjustable stop device comprises a movable stop member against which the elements can abut to limit their movement away from the tube and means for varying the distance of the stop member relatively to the tube.

11. A pump as claimed in any one of the preceding claims wherein the recovery of the tubular shape of the flexible tube after being deformed is brought about by the elastic memory of the tube wall.

12. A glandless flexible tube pump as herein described with reference to the drawing accompanying the Provisional Specification.

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olished at the Patent Office, 25 Southampton Buildings, London, W.C.2 from which copies may be obtained.

1081818 PROVISIONAL SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

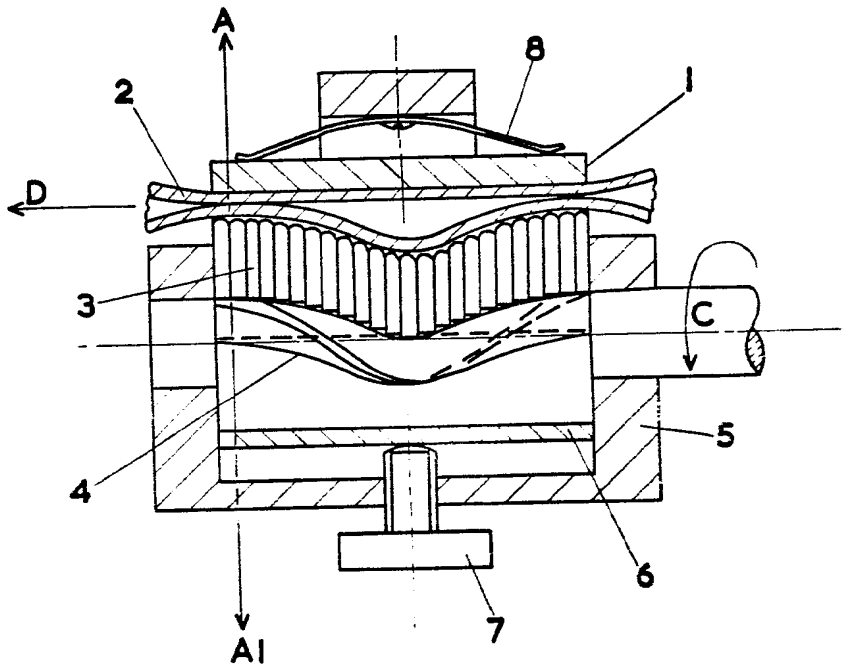

FIGURE 1

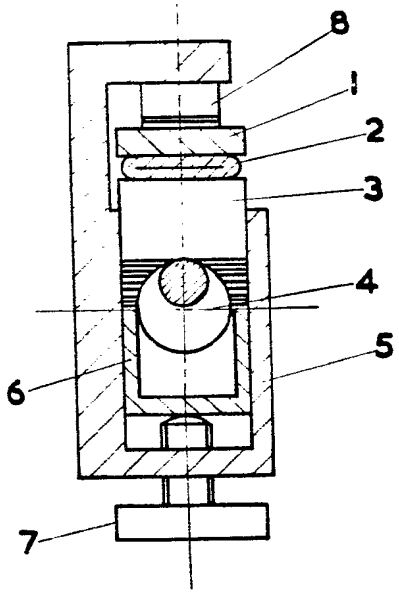

FIGURE 2